

What is claimed is:

1. A method of fabricating a semiconductor device, comprising the steps of:

5 placing a substrate in a chamber;

 introducing a gas having a thermal conductivity of 0.1 W/mK or greater into the chamber, thereby contacting the gas with the substrate for stabilization of a temperature of the substrate; and

10 depositing a desired dielectric layer on or over the substrate in the chamber using a PECVD method after the step of introducing the gas.

2. The method according to claim 1, wherein hydrogen (H₂) or
15 helium (He) gas is used as the gas having a thermal conductivity of 0.1 W/mK or greater.

3. The method according to claim 1, wherein a dielectric layer made of one selected from the group consisting of SiCH, SiCHN,
20 and SiOCH is used as the desired dielectric layer.

4. The method according to claim 1, wherein a SiCH layer is used as the desired dielectric layer;

 and the SiCH layer is deposited on or over the

substrate using an organic silane and an inert gas.

5. The method according to claim 1, wherein a SiCHN layer is used as the desired dielectric layer;

5 and the SiCHN layer is deposited on or over the substrate using an organic silane, an inert gas, and a nitrogen-containing gas.

6. The method according to claim 1, wherein a SiOCH layer is
10 used as the desired dielectric layer;

and the SiOCH layer is deposited on or over the substrate using an organic silane, an inert gas, and an oxidizing gas.

15 7. The method according to claim 4, wherein at least one selected from the group consisting of trimethylsilane $[(CH_3)_3Si]$, tetramethylsilane $[(CH_3)_4Si]$, and trimethylvinylsilane $[(CH_3)_3SiCH=CH_2]$ is used as the organic silane.

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8. The method according to claim 5, wherein at least one selected from the group consisting of trimethylsilane $[(CH_3)_3Si]$, tetramethylsilane $[(CH_3)_4Si]$, and trimethylvinylsilane $[(CH_3)_3SiCH=CH_2]$ is used as the organic

silane.

9. The method according to claim 6, wherein at least one selected from the group consisting of trimethylsilane
5 $[(CH_3)_3Si]$, tetramethylsilane $[(CH_3)_4Si]$, and trimethylvinylsilane $[(CH_3)_3SiCH=CH_2]$ is used as the organic silane.

10. The method according to claim 4, wherein at least one
10 selected from the group consisting of helium (He), argon (Ar), and xenon (Xe) is used as the inert gas.

11. The method according to claim 5, wherein at least one selected from the group consisting of helium (He), argon (Ar),
15 and xenon (Xe) is used as the inert gas.

12. The method according to claim 6, wherein at least one selected from the group consisting of helium (He), argon (Ar), and xenon (Xe) is used as the inert gas.

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13. The method according to claim 5, wherein ammonia (NH₃) is used as the nitrogen-containing gas.

14. The method according to claim 6, wherein at least one

selected from the group consisting of oxygen (O_2), ozone (O_3), carbon monoxide (CO), carbon dioxide (CO_2), and water (H_2O) is used as the oxidizing gas.

5 15. A method of fabricating a semiconductor device, comprising the steps of:

placing a substrate in a chamber;

introducing hydrogen (H_2) or helium (He) gas into the chamber, thereby contacting the gas with the substrate for
10 stabilization of a temperature of the substrate;

introducing an organic silane and an inert gas into the chamber after evacuating the hydrogen (H_2) or helium (He) gas; and

depositing a SiCH layer on or over the substrate using
15 the organic silane and the inert gas while plasma is present in the chamber.

16. The method according to claim 15, wherein the SiCH layer is deposited on a copper wiring.

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17. The method according to claim 15, wherein at least one selected from the group consisting of trimethylsilane $[(CH_3)_3Si]$, tetramethylsilane $[(CH_3)_4Si]$, and trimethylvinylsilane $[(CH_3)_3SiCH=CH_2]$ is used as the organic

silane.

18. The method according to claim 15, wherein at least one selected from the group consisting of helium (He), argon (Ar),
5 and xenon (Xe) is used as the inert gas.

19. A method of fabricating a semiconductor device, comprising the steps of:

placing a substrate in a chamber;

10 introducing hydrogen (H_2) or helium (He) gas into the chamber, thereby contacting the gas with the substrate for stabilization of a temperature of the substrate;

introducing an organic silane, an inert gas, and a nitrogen-containing gas into the chamber after evacuating the
15 hydrogen (H_2) or helium (He) gas; and

depositing a SiCHN layer on or over the substrate using the organic silane, the inert gas, and the nitrogen-containing gas while plasma is present in the chamber.

20 20. The method according to claim 19, wherein the SiCHN layer is deposited on a copper wiring.

21. The method according to claim 19, wherein at least one selected from the group consisting of trimethylsilane

$[(CH_3)_3Si]$, tetramethylsilane $[(CH_3)_4Si]$, and trimethylvinylsilane $[(CH_3)_3SiCH=CH_2]$ is used as the organic silane.

5 22. The method according to claim 19, wherein at least one selected from the group consisting of helium (He), argon (Ar), and xenon (Xe) is used as the inert gas.

23. The method according to claim 19, wherein ammonia (NH_3) is
10 used as the nitrogen-containing gas.

24. A method of fabricating a semiconductor device, comprising the steps of:

placing a substrate in a chamber;

15 introducing hydrogen (H_2) or helium (He) gas into the chamber, thereby contacting the gas with the substrate for stabilization of a temperature of the substrate:

introducing an organic silane, an inert gas, and an oxidizing gas into the chamber after evacuating the hydrogen
20 (H_2) or helium (He) gas; and

depositing a $SiOCH$ layer on or over the substrate using the organic silane, the inert gas, and the oxidizing gas while plasma is present in the chamber.

25. The method according to claim 24, wherein the SiOCH layer is deposited on a SiCHN layer.

26. The method according to claim 24, wherein at least one selected from the group consisting of trimethylsilane $[(CH_3)_3Si]$, tetramethylsilane $[(CH_3)_4Si]$, and trimethylvinylsilane $[(CH_3)_3SiCH=CH_2]$ is used as the organic silane.

27. The method according to claim 24, wherein at least one selected from the group consisting of helium (He), argon (Ar), and xenon (Xe) is used as the inert gas.

28. The method according to claim 24, wherein at least one selected from the group consisting of oxygen (O_2), ozone (O_3), carbon monoxide (CO), carbon dioxide (CO_2), and water (H_2O) is used as the oxidizing gas.